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H04Q 7/38 7/32

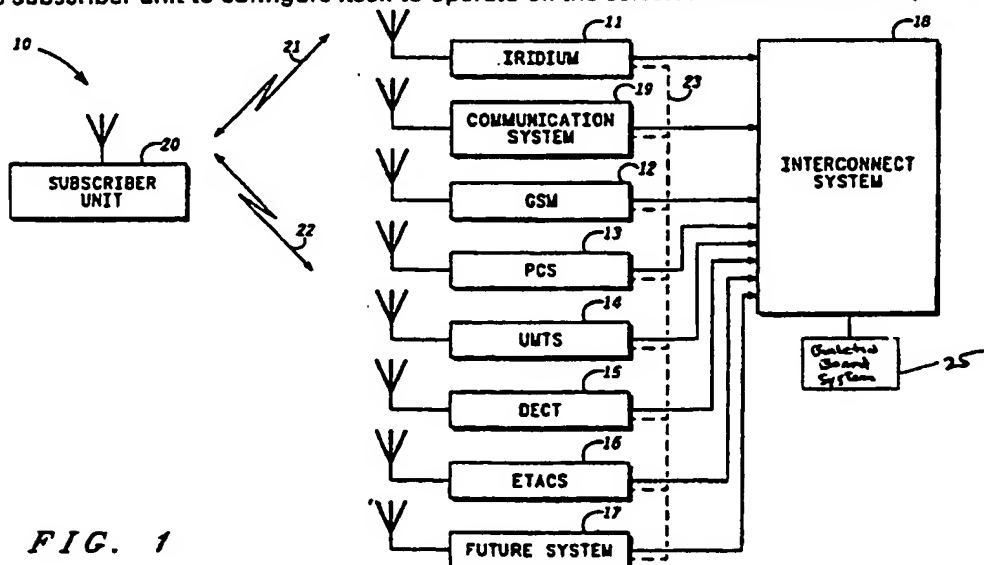
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GB 2294844 A

(58) Field of Search
UK CL (Edition O) H4L LD LX LDSC LDSK LDSM LECC
INT CL⁶ H04Q 7/20 7/22 7/30 7/32 7/38
On-Line: WPI

(54) Selecting data relevant to multiple communication systems in vicinity of a programmable subscriber unit

(57) A common communications system 19 provides information regarding the availability of other local communication systems 11-17 within the common communications system coverage area to a generic, programmable subscriber unit 20. Geographical location information is then supplied to the common communications system indicating position of the subscriber unit. This information is used by either the common communication system or subscriber unit to provide information pertinent only to one or more local communications systems 11-17 that the subscriber unit may select. The common communication system or the subscriber unit can also be used to selectively filter or extract information such that the information presented to the user is related to the geographical location. The subscriber unit then selects one of the local communications systems 11-17 and receives programming from that local communication system, thereby enabling the subscriber unit to configure itself to operate on the selected communication system.



The references to figure 9 of the drawings in the printed specification are to be treated as omitted under Section 15(2) or (3) of the Patents Act 1977.

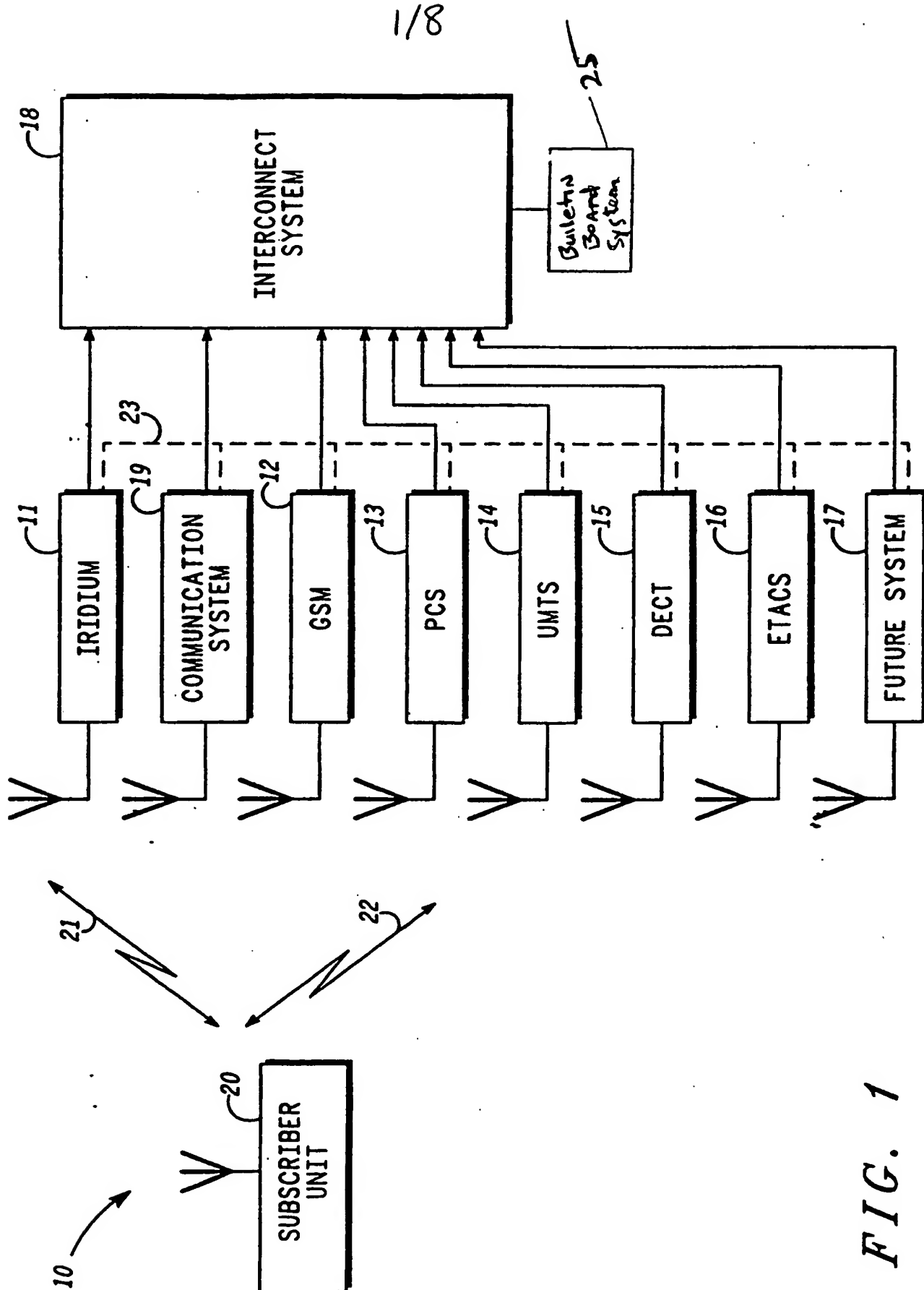


FIG. 1

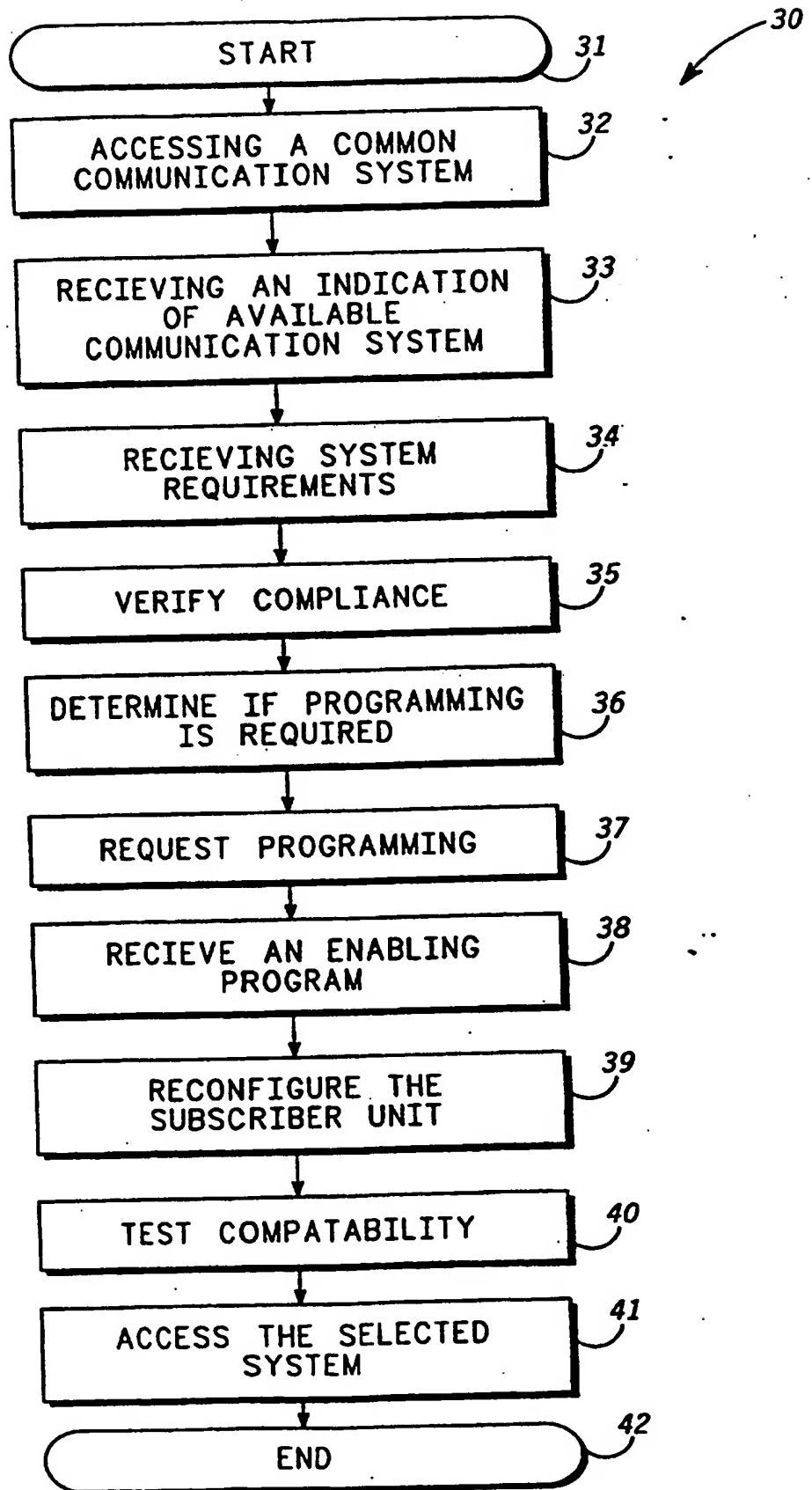


FIG. 2

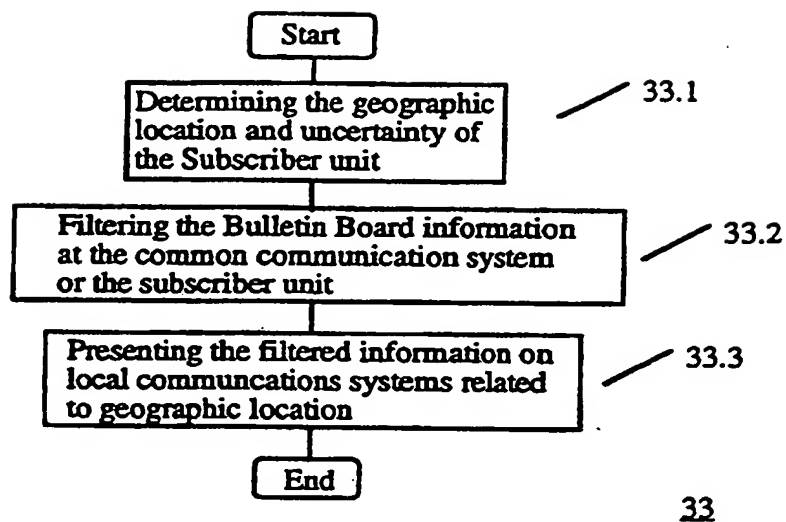


FIG. 3

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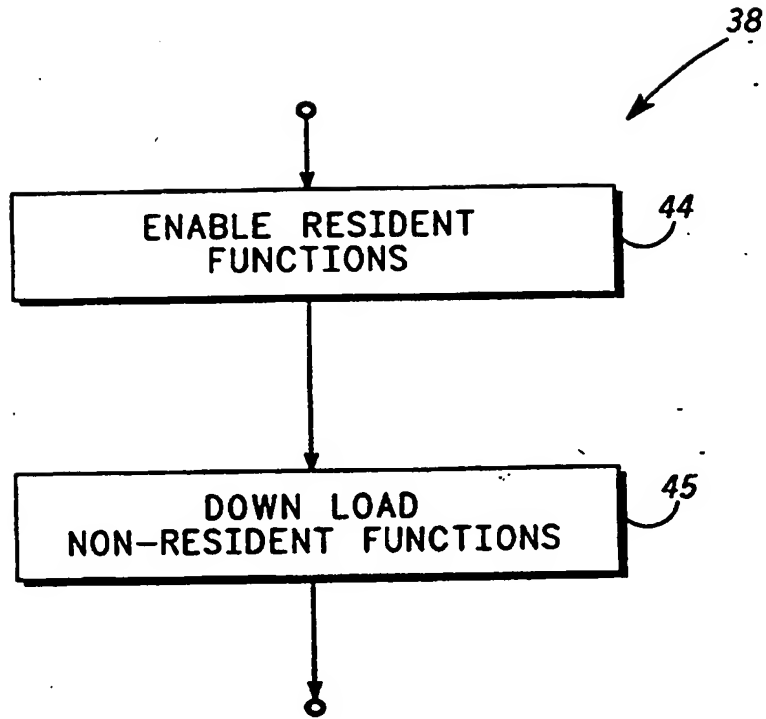


FIG. 4

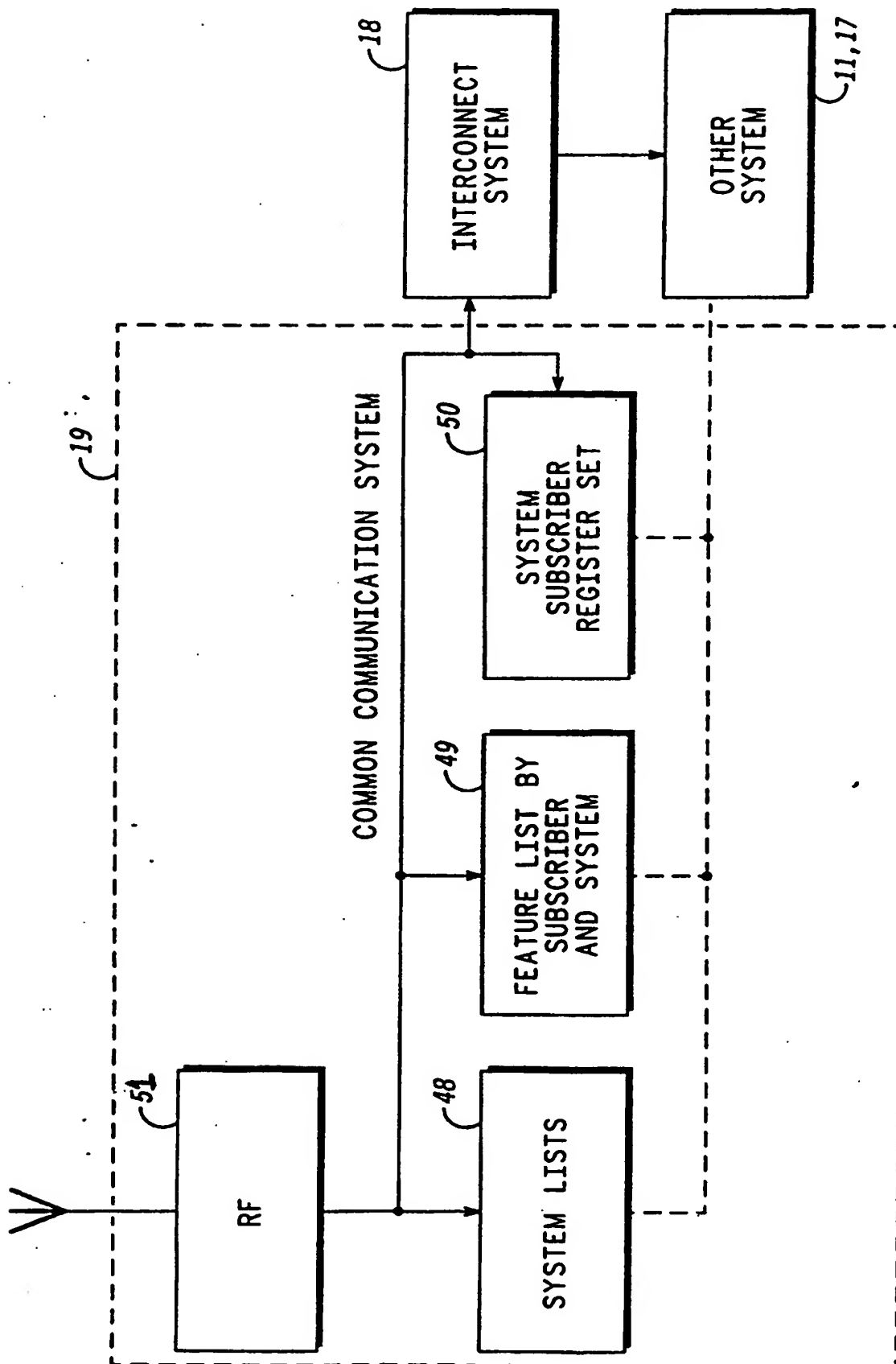


FIG. 5

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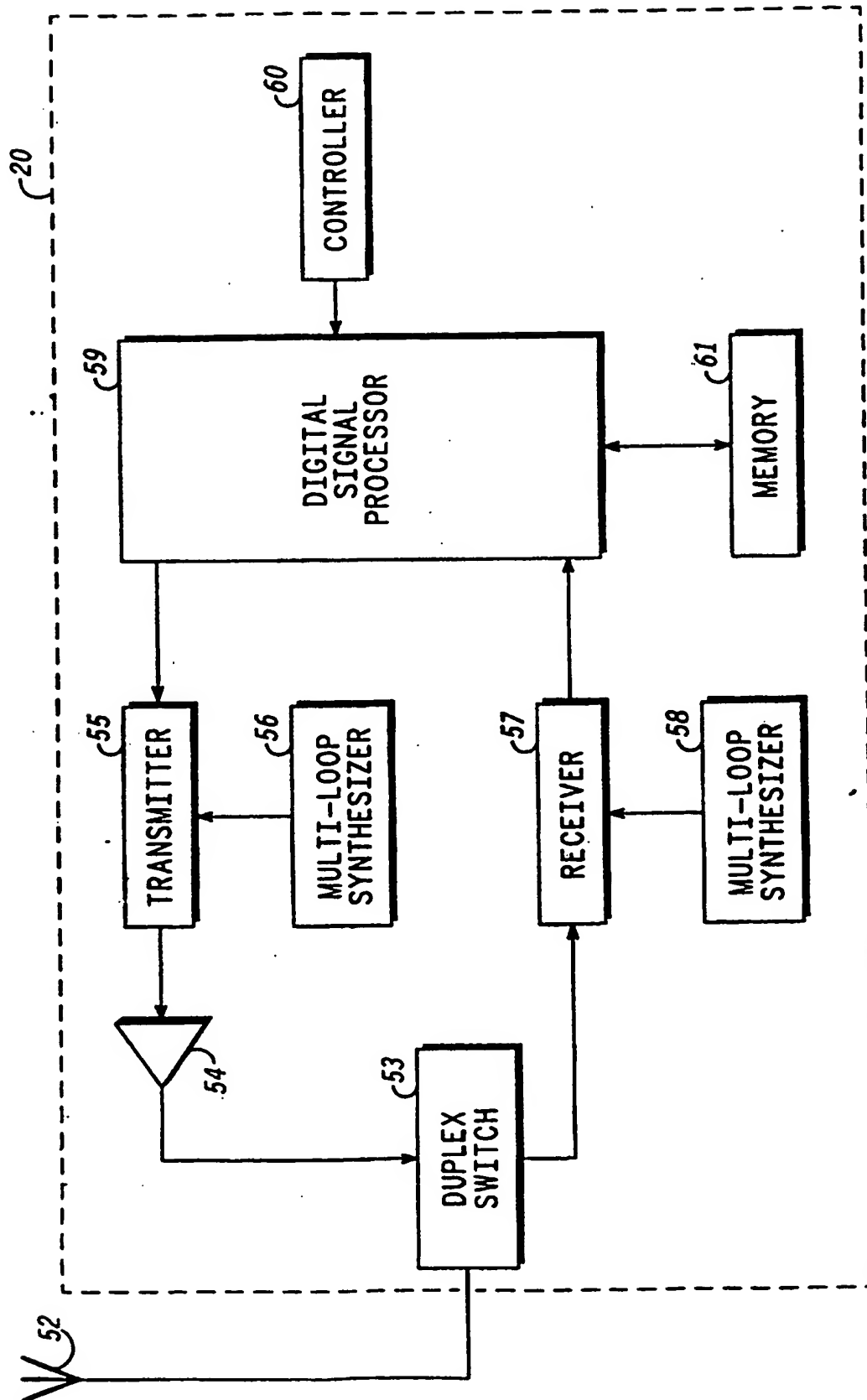


FIG. 6

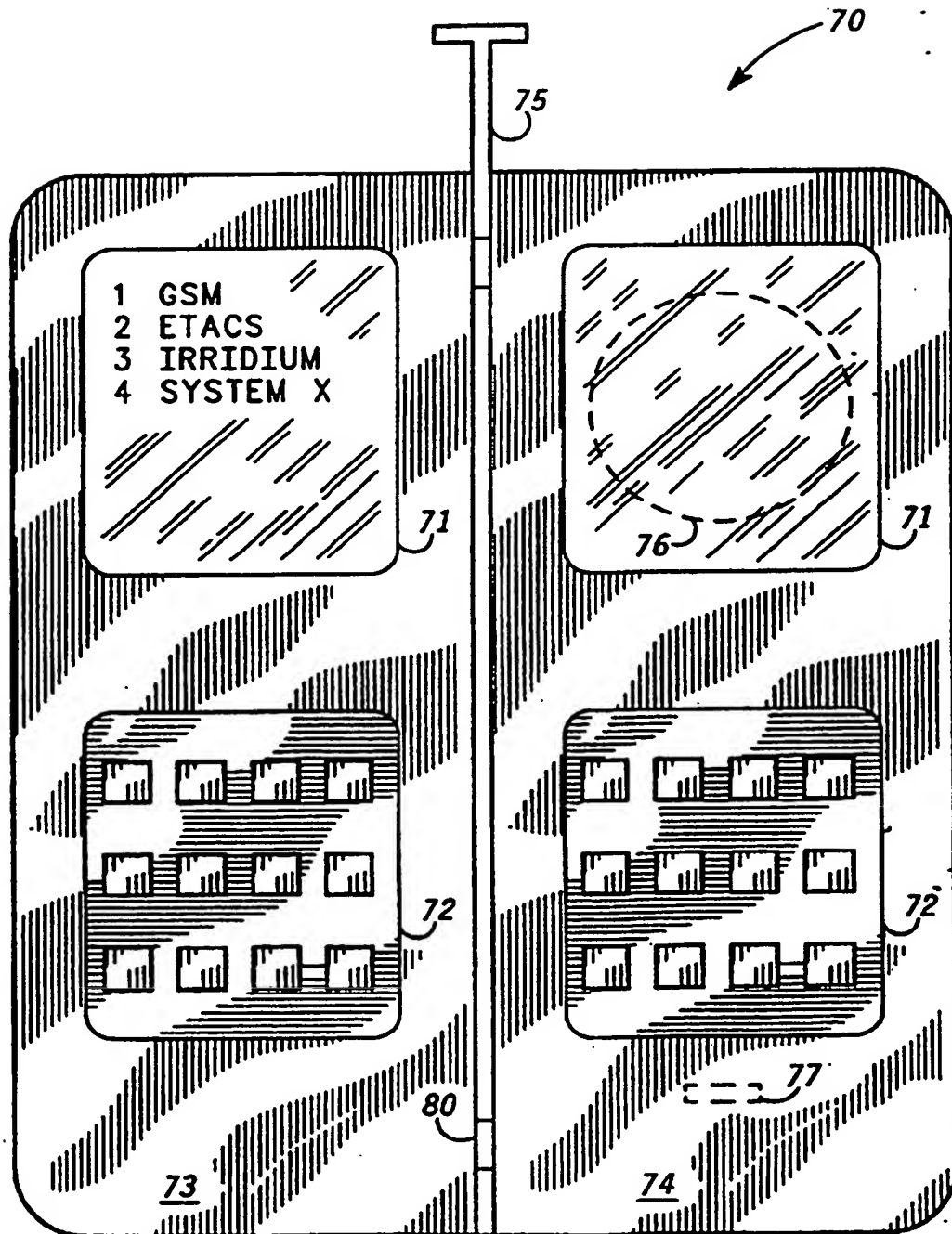


FIG. 7

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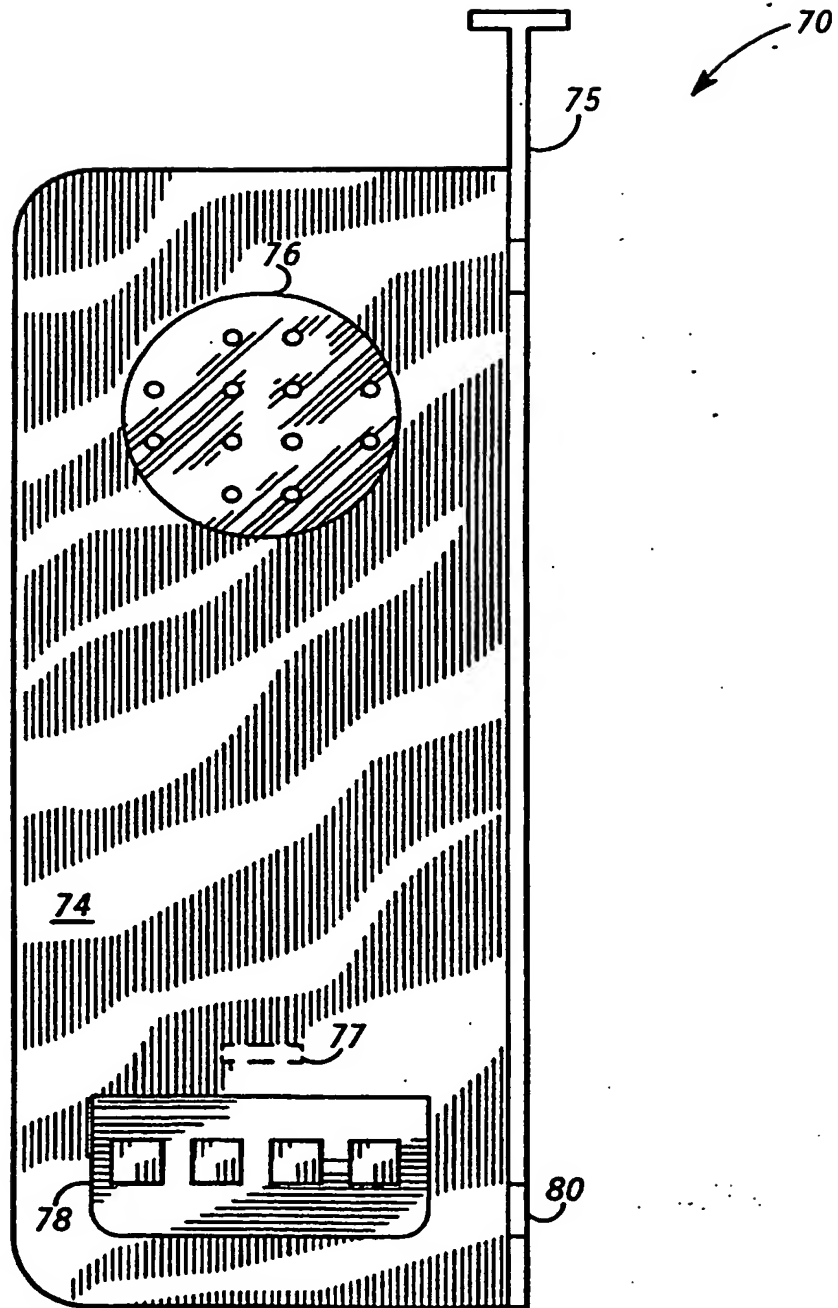


FIG. 8

COMMUNICATIONS OPERATING SYSTEM AND METHOD THEREFOR**Field of the Invention**

5 The present invention relates, in general, to communication systems and, more particularly, to a communications operating system and method therefor.

Background of the Invention

10 Within the past several years, radio frequency (RF) communication systems have gone from a very limited number of systems, each available for one type of function, to a vast number of potential systems available for providing the same type of basic service. For example, cellular communication systems began in Europe with the Nordic Mobile Telephone (NMT) system. At the time, this was the only system which
15 provided mobile dial-up telephone operations. Since its introduction, newer analog systems have been introduced, such as Total Access Communication System (TACS), and, more recently digital systems such as the Groupe Spécial Mobile (GSM) (now commonly referred to as the
20 Global System for Mobile communications), DCS-1800 (Digital Cellar System), CT-2 (Cordless Telephone), and DECT (Digital European Cordless Telephone) systems. Further, there are considerable numbers of systems each serving a specific customer service demand such as the European Radio Messaging System (ERMES) for paging and Ministry of Posts and
25 Telecommunications standard MPT 1327 (A Signaling Standard to Trunked Private Land Mobile Radio Systems) for private mobile radio applications. These systems often overlap in their coverage areas, thereby giving users an option as to which system to select.

 There is also a proliferation of new systems being developed, such as
30 the American Digital Cellular (ADC), referred to as Interim Standard 54 (IS-54), and a Personal Digital Cellular (PDC) standard being developed in Japan, referred to as the RCR (Research & Development Center for Radio Systems) standard 27. There is also a Code Division Multiple Access (IS-95) system being developed as a higher capacity/higher quality alternative
35 to the existing systems. In addition to what is normally considered cellular, there are a number of Personal Communication Systems (PCS) and wireless local loop systems being developed that are all competing for customers. Some of these systems will be based on existing protocols (such

as the DCS-1900 (Digital Cellular System) being based upon GSM). Also, some previous land mobile trunking systems are offer dial-up telephony services. One future system currently under design is the Future Land Mobile Public Telephone System (FLMPTS).

5 However, one problem for the end user is that to be able to go anywhere in the world and use a subscriber unit, the user would need to carry a dozen or more subscriber units since one unit will not operate on all of the systems. By way of example, even though GSM and ADC operate on similar Time Division Multiple Access (TDMA) technologies, there is
10 presently no way to take your GSM phone to America and have it operate on a ADC system.

 In addition, even within the same system, the mobile owned by a user may have limitations built in during its original programming that prevent it from using features subsequently developed for a particular
15 system. While there are some subscriber units available today that can be returned and reprogrammed (either electronically or by replacing some of the memory devices containing the programming), the user often finds themselves with a subscriber unit that has become obsolete in just a short time.

20 A related invention is found in "Bulletin Board Resource for Communication System Access" (US-A-5,301,359) invented by VandenHuevel et al. and assigned to Motorola Inc. This invention describes a method of providing information regarding communication system capabilities for multiple, independent RF communication systems.
25 The method comprises the steps of monitoring an RF bulletin board that is independent of the multiple, independent RF communication systems; and receiving information from the RF bulletin board regarding the multiple RF communication systems. The system providing the RF bulletin board is called the "bulletin board system" or "common communications system".

30 Another type of system is described in EP-A2-0 365 200, Majbudar et al. This application describes a telecommunication system in which a subscriber (which includes a touch screen display and a customer premises computer) can, by use of the computer, transmit a request to a central office to provide an appropriate software package to activate a
35 feature of the phone. This application is similar, and in fact uses, a standard ISDN process to transfer a program from one computer to another. The result then is that while certain features in the phone may be

activated, it does not address the issue of providing access to multiple communication systems operating using different protocols.

5 The bulletin board system provides a subscriber unit with information about systems and services within the coverage area of the bulletin board system. It can be expected that there will be a mismatch
10 between the coverage area of the bulletin board and the coverage area of the communications system with which the subscriber unit will eventually communicate. This mismatch can come about when a bulletin board provider uses a wholly different radio infrastructure
15 than the target system communications system. An example of this would be where the bulletin board system is provided by a satellite system, such as Iridium and the target system is a national cellular system, such as GSM.

15 Although it may be technically possible to provide a close match between the bulletin board system coverage area and the target system coverage area, this may be challenging to engineer and/or consume valuable spectrum resources from the target system. A user will want to know about services local to him, however the bulletin board operator will not want to deploy equipment at many small cell sites.
20 This problem is especially relevant where an operator provides bulletin board information on behalf of other operators.

For reasons of efficiency, the bulletin board system should only provide information about a specific target or local communications system to subscriber units which are in the vicinity of that target
25 system. In effect, the bulletin board system should be capable of mimicking the coverage area of a particular target communications system when providing information about that local communications system to subscribers.

Thus, a problem exists in providing only relevant bulletin board
30 information from a wide area bulletin board provider to a subscriber unit that is only pertinent to the geographic location of the subscriber unit.

Summary of the Invention

A configurable subscriber communications unit operable in at least one local communications system and receiving general information from a common communications system, comprising: a receiver; a transmitter; a memory circuit; and a controller coupled to the transmitter, the receiver, and the memory circuit, the controller responsive to the information received from the receiver to identify the geographic location of the subscriber communications unit, and the controller using the geographic location to selectively extract information from the general information such that only pertinent information relating to the at least one local communications system for the geographic location is presented to a user.

Brief Description of the Drawings

FIG. 1 is a block diagram of a network utilizing the present invention;

FIG. 2 is a flow chart illustrating a process embodying the present invention;

FIG. 3 is a flow chart illustrating a subprocess of the receiving system requirements process shown in FIG. 2.

FIG. 4 is a flow chart illustrating a subprocess of the process illustrated in FIG. 2;

FIG. 5 is a more detailed block diagram of the common communication system of FIG. 1;

FIG. 6 is a more detailed block diagram of the subscriber unit of FIG. 1;

FIG. 7 is a frequency band chart; and

FIG.s 8 and 9 illustrate designs of a subscriber unit which may potentially utilize the present invention.

Detailed Description of the Drawings

Referring initially to FIG. 1, a block diagram of a network, generally designated 10, utilizing the present invention is illustrated. In network 10, there are a plurality of communication systems 11-17 all coupled through an interconnect or wireline system 18 to a common communication system such as Bulletin board system 19. Interconnect system 18 would potentially be a wireline system, such as an Integrated Services Digital Network (ISDN). The systems may also be directly connected along line 23.

In FIG. 1, a subscriber 20 is seeking access to one of the local communication systems in network 10. To accomplish this task,

subscriber 20 will first access common communication system 19 using a channel 21. Common communication system 19 will then reply to subscriber 20 with a list of local communications systems available for use in network 10. Along with the list of available local communication systems, system 19 may also provide information on types of features available and on system costs. All information is collectively referred to as bulletin board information.

In order to insure that only pertinent information is transmitted to the subscriber 20, related to one or more of the communications systems 11-17, information or data relating to geographic location of the subscriber 20 is used to extract the appropriate information. The bulletin board system 25 operates with the interconnect system 18, to provide service information relating to one or more of the communications systems 11-17.

Thus, in order to insure that only selective and relevant bulletin board information is given to a subscriber 20, even though much more bulletin board information is available, the bulletin board system 19 can give the proper information when combined with a geo-location capability. This allows a bulletin board operator to deploy wide area channels but to use the geo-location information to provide information pertaining to target systems which are available at the location of the subscriber 20. The bulletin board system 19 has stored information describing the coverage areas of the various communications systems 11-17 that are available.

In order to utilize the geo-location information with the bulletin board information, to insure that only pertinent information is sent to the subscriber 20, two embodiments are possible. In the first embodiment, a bulletin board cellular information service is utilized which includes a plurality of bulletin board cells. Each bulletin board cell broadcasts all the bulletin board information about communications systems 11-17 that are available within the coverage area of the bulletin board cell.

This information includes data regarding the coverage areas of the target systems. In order to insure that only relevant information is received, the subscriber 20 uses information from its own geo-location process together with the coverage areas of the various possible local communications systems 11-17, as provided by the bulletin board cell broadcast, to determine which systems are locally available. Thus, the

subscriber 20 selectively filters and separates the bulletin board information so that only pertinent bulletin board information regarding local communications systems 11-17 is displayed to the user and/or used for system selection. The subscriber 20 then selects an
5 appropriate local communication system 11-17 and acquires the necessary information from the bulletin board cell to enable the subscriber 20 to access the selected local communications system 11-17.

In the second embodiment, the subscriber 20 performs the geo-location process and informs the bulletin board system 19 of the
10 subscriber unit's geographical location. The bulletin board system 19 then uses this location information in conjunction with the information about the respective coverage areas of the various target or local communications systems 11-17. The bulletin board system 19 then provides the appropriate filtering to extract irrelevant bulletin
15 board information. The bulletin board system 19 subsequently informs the subscriber 20 about each candidate local communications system 11-17 for which the subscriber 20 falls inside the coverage area as defined by the bulletin board system 19.

The subscriber 20 then selects a suitable local communications
20 system 11-17 and acquires the necessary information from the bulletin board system 19 to access the selected target communication system 11-17. This embodiment uses non-broadcast, point to point information transfer for the process of informing the subscriber 20 of the possible local communications systems 11-17. As will be evident to those skilled
25 in the art, the choice of implementation will depend on the cell sizes and the number of subscriber units 20 and will be made to minimize spectrum requirements for given performance.

In order to provide geographical information to the bulletin board service, a location function will be used. The location function
30 may be active or passive. For example, an active technique may use timing advance information from a number of simultaneously observed transmitters, or an active geo-location technique from mobile satellite system (MSS). A passive technique includes both LORAN or GPS services that passively supply highly accurate global positioning
35 information directly to a receiver without Doppler calculations or the like. It should also be recognized that the infrastructure for geo-location and positioning may be the same as that which provides the bulletin board services.

Depending on the geo-location technique employed, there may be uncertainty as to the exact location. For example, some techniques may only be accurate to within +/- 25km, whereas others can be accurate to less than 100m. The tolerance on the location information must be known in order that possible local communications systems 11-17 are not falsely eliminated from the selection process. Clearly the more the uncertainty of the outcome of the geo-location process, the less valuable this technique will be. However, so long as the area of location uncertainty is significantly smaller than the size of the bulletin board cell, these techniques can still improve the efficiency of the bulletin board system 19 and eliminate the need to have bulletin board cells implemented with virtually the same physical coverage as the target communication system 11-17. Ultimately, this results in the ability to avoid having one bulletin board system 19 for each local communications system 11-17.

Obviously, the greater the accuracy of the geo-location process, the more accurate will be the selection of the local communications system 11-17, and the more efficient will be the provision of the bulletin board service, since unreachable local communications systems 11-17 will be eliminated before any download information, describing the unreachable target system, is required.

Once subscriber 20 has determined which system it desires to utilize, it will make a request to common communication system 19 and receive an enabling program for the selected communication system. Subscriber 20 will then open a channel 22 with the selected communication system, in this case Universal Mobile Telecommunication System (UMTS) 14.

The process of accessing the selected communication system is illustrated in more detail in FIG. 2, by a process, generally designated 30. Process 30 begins with step 31. This may be implemented when a user starts to make a call using a subscriber unit or when a user first enters an area covered by the common communication system. The subscriber 20 then accesses the common communication system, step 32. This may be performed passively, in that the subscriber unit may only monitor the information being transmitted by the common communication system. However, at some point, the subscriber unit will need to request and be assigned to a channel of the common communication system.

Once the subscriber has accessed the channel of the common communication system, it receives an indication of available communication systems within the coverage area of this common communication system, step 33 or within the coverage area of the subscriber 20. This indication of available systems may be general, as in a "GSM" system is available; or provide more detail, such as a "half-rate GSM" system is available or one with a particular feature. At this point, the common communication system may also provide a list of any requirements of a particular communication system, step 34. Such requirements may include display capabilities, power, frequency band, modulation scheme, etc.

The preferred method of operating the a subscriber unit to access a preferred local communication system such as the communications systems shown in FIG. 1 is described in more detail hereinafter. As indicated above the common communications system is accessed 32 and an indication of available local communication systems is received 33. The local communications system information is related to all of the options and services for any number of the local communications systems. A geographic location of the subscriber unit is determined 33.1 together with a measure of uncertainty which is then used by the subscriber unit or the common communication system to extract, eliminate and/or filter 33.2 irrelevant information for the whole of the available information. Therefore, only information relating to preferred communications system is presented 33.3 to the subscriber unit. Generally, the information relating to the preferred local communications systems will correspond to those local communications systems available for that geographic location.

As described in better detail hereinafter, the subscriber unit may then receive system requirements of one or more systems determined to be local 34 and then request access 35 to those local communications systems that are identified. As will be evident to those skilled in the art, this provides a user of the subscriber unit only with relevant and pertinent bulletin board information for those local communications systems available in subscriber unit's geographic location. Thus, little or no extraneous bulletin board information need be presented to the user even if using a wide-area bulletin board network. Subsequently, this step would then be followed by a verification by the subscriber unit that it is, or can be made, compliant with any of those requirements, step 35.

The subscriber units for this type of system are capable of being programmed over the air and may also be provided with stable memory of some pre-programmed systems. Depending upon the system selected and the resident programming of the subscriber unit, the subscriber unit then
5 determines if any non-resident programming is required, step 36. If programming is required, the subscriber unit will request the programming from the common communication system, step 37. The common communication system will respond by transmitting the enabling program, which will be received by the subscriber unit, subprocess 38.

10 Subprocess 38 will generally consists of one or more of the steps illustrated in FIG. 4. In order to be enabled to function on a selected communication system, the subscriber unit may require certain programming. This programming may be provided either by-way of enabling functions that are already resident in the subscriber unit, step 44;
15 or by providing non-resident functions, step 45. A type of resident function may be an indicator of what type of coding or encryption process is used by the selected system. The subscriber unit would have several of these present in memory and only need to be told which one to utilize. An example of a non-resident function would be any new type of capability that
20 may be added to the system. For example, a new type of hand-off algorithm may have been implemented since the subscriber unit's last memory update.

The non-resident function provided to the subscriber unit may be provided either by providing a specification that can be executed directly by
25 the subscriber unit; or by providing a high level design specification. If a high level design specification is provided, the subscriber unit will generate, or elaborate, its own executable specification. As part of this, non-resident functions, once received, may be stored in a non-volatile memory thereby becoming resident functions. Along with this, older
30 resident functions may be removed from the subscriber unit.

Returning now to FIG. 2, process 30 continues with step 39 where the subscriber unit configures itself to operate on the selected communication system. When this occurs, the subscriber unit may disconnect from the common communication system, or it may remain in
35 contact. This would probably, but not necessarily, require a dual mode type of subscriber unit. This concept is known in the art and is currently available for subscriber units operating on both AMPS and ADC systems in the United States of America.

After the subscriber unit has been configured, step 39, it will then test its compatibility, step 40, by determining if it meets any requirements of the selected communication system. If the test is satisfactory, the subscriber unit will then access the selected communication system, step 41. This may be accomplished through the receipt of a hand-off instruction from the common communication system or by a direct request from the subscriber unit. Once the access has been completed, process 30 ends, step 42.

Referring now to FIG. 5, a more detailed block diagram of common communication system 19 is provided. System 19 would preferably consist of RF equipment 52 as normally associated with any mobile communication system. The particular protocol of operation is not important for the present invention, but would, for example, be a derivative of one of the basic type of system. Alternatively, the protocol may be a completely new design to maximize its efficiency. In addition, system 19 would contain a list 48 of other communication systems available. This list may be a simple list of systems available or it may contain additional information on the individual systems. This additional information may be feature capabilities, system requirements, system cost, etc.

Common system 19 will also contain a feature list 49. This list would be in the form of a matrix having features cross referenced by subscriber unit capabilities. In addition, each feature would have either or both of an executable specification a high level design specification. This list would then be used to generate the programming information sent to the subscriber unit.

Common system 19 may also contain a system subscriber register 50 for all of the systems in the network. With this information, the system may determine if the subscriber unit is permitted access to the selected system before taking resources to provide the subscriber with the programming requested. It can also be used by the other systems, either by way of interconnect system 18 or directly by bus 23, to set-up billing information on the subscriber. An alternative method would be to locate this register with the individual systems.

In FIG. 6, a general block diagram of subscriber 20 is illustrated. Subscriber 20 has the typical duplex switch 53 for coupling an antenna 52 to transmitter 55 and receiver 57. Transmitter 55 is coupled to duplex switch 53 through an amplifier 54. Transmitter 55 and receiver 57 each have multi-loop synthesizers 56 and 58, respectively. Synthesizers 56 and

58 permit subscriber 20 to operate at different frequency ranges. It should be noted here, that while subscriber 20 is meant to be a generic, programmable type of radiotelephone, it is not necessarily meant to work in every possible system. For example, in FIG. 6 a frequency band chart of many of today's existing and planned systems is presented. Subscriber 20 may be designed to operate over a series of these systems, such as Band I or Band II (or the lower or upper portions of Band II).

Moreover, the subscriber 20 further consists of a digital signal processor (DSP) 59, a controller 60, and a memory 61. When the enabling program is received from the network, controller 60 will use this to coordinate the programming of DSP 59. As described above, some of the functions may be resident in subscriber 20. For resident functions, the executable code will be retrieved from a memory 61, which may, if preferable, be physically located in DSP 59 or controller 60.

Finally, in FIG.s 7 and 8, a design of a subscriber unit 70 capable of utilizing the present invention is illustrated. Subscriber unit 70 is a combination personal data assistant (PDA) and radiotelephone. It consists of a display 71 and a keypad 72 which are each divided between two portions, 73 and 74, of PDA 70. Portions 73 and 74 are joined by a hinge 80 which permits the two portions to be closed upon each other, as illustrated in FIG. 8. On the outside of portion 74 is a speaker 76 and an microphone 77. Optional keys, or buttons, 78 are also provided on the outside portion to be used for certain general functions such as: call answer, call end, power on/off, etc.

In operation, when PDA 70 accesses the common network, a list of available systems is displayed in display 71. The user can then select the system desired using the keypad. The process described above in FIG. 2 will then continue by providing enabling programming to PDA 70. PDA 70 may then be closed and used as radiotelephone.

Thus, it will be apparent to one skilled in the art that there has been provided in accordance with the invention, a communications operating system and method of operation that fully satisfies the objects, aims, and advantages set forth above.

While the invention has been described in conjunction with specific embodiments thereof, it is evident that many alterations, modifications, and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended to embrace all such alterations, modifications, and variations in the appended claims.

What is claimed is:

CLAIMS

1. A method of operating a subscriber unit to access a preferred local communication system, said method characterized by the steps of:
accessing a common communication system;
5 receiving communication system information from said common communication system about at least one local communication system within the common communication system's coverage area;
determining the geographic location of the subscriber unit; and
filtering the communication system information to identify the
10 preferred local communication system that is available in the geographic location of the subscriber unit; and
presenting the filtered information to the subscriber unit.
2. The method as in claim 1 further characterized by the step of:
15 requesting access at the subscriber unit to the identified preferred local communication system.
3. The method of claim 1 further characterized by the step of:
configuring the subscriber unit to operate in accordance with a
20 protocol of said identified communication system.
4. The method of claim 3 further characterized by:
requesting downloading of an enabling program from the common
communication system and receiving the enabling program, and
25 loading the enabling program into a memory of the subscriber terminal to enable operation of the subscriber unit in the identified system.
5. The method as defined in claim 1, 2, 3 or 4, wherein the common communication system is a satellite system, and further including the step
30 of receiving information of geographic location from the satellite system.
6. The method as defined in claim 1 or 5, wherein the geographic location includes a geographic area and a tolerance area, and the step of filtering includes eliminating all systems that are outside of the tolerance
35 area around the geographic location.

7. The method as defined in claim 1, 2 or 3 wherein the step of determining the geographic location includes receiving information from a global positioning system.

8. A method of operating a common communication system controller to inform at least one subscriber unit of local communication system information, said method comprising the steps of:

5 identifying the geographic location of the at least one subscriber unit;

determining if the subscriber unit is configured to support a local communication system in the geographic location in which the subscriber unit is located; and

10 presenting selective local communication system information to the at least one subscriber based on the geographic location.

9. The method as defined in claim 8, further comprising the step of: downloading enabling software to enable operation of the at least one subscriber unit with the local communication system.

15

10. The method as defined in claim 8, further comprising the steps of: supplying information on local systems to subscriber unit; and receiving a selection of local system from the subscriber unit.

20 11. The method as defined in claim 8, wherein the step of identifying includes:

calculating the geographic location of the subscriber unit based upon the time period for the transmission of signals between the common communication system receiver and the at least one subscriber unit.

25

12. The method as defined in claim 8, wherein the step of identifying the geographic location includes receiving geographic position information from the at least one subscriber unit.

30 13. The method as defined in claim 8, wherein a controller in the common communication system identifies all of the local communications systems covering the geographic location of the at least one subscriber unit, said step of presenting further includes downloading operating information from at least one of the identified local communication systems selected by the at least one subscriber unit.

35

14. A configurable subscriber communications unit operable in at least one local communications system and receiving general information from a common communications system, comprising:
- a receiver;
 - 5 a transmitter;
 - a memory circuit; and
 - a controller coupled to the transmitter, the receiver, and the memory circuit, the controller responsive to the information received from the receiver to identify the geographic location of the subscriber
 - 10 communications unit, and the controller using the geographic location to selectively extract information from the general information such that only pertinent information relating to the at least one local communications system for the geographic location is presented to a user.
- 15 15. A common communication system for providing information on at least one local communications system, comprising:
- a receiver;
 - a transmitter;
 - a memory; and
 - 20 a controller, the controller coupled to the receiver, the transmitter and the memory, the controller receiving geographic information for determining the geographic location of a subscriber terminal, and communicating operating information to the subscriber terminal for enabling operation of the subscriber terminal in the at least one local
 - 25 communication system where the subscriber terminal is located.
16. A common communication system as in claim 15, wherein the controller provides only selective operating information to the subscriber terminal pertinent to the subscriber terminal's geographic location.
- 30 17. A method substantially as hereinbefore described with reference to FIG.s 2 and 3 of the accompanying drawings.
18. A configurable subscriber communications unit as hereinbefore
- 35 described with reference to FIG.s 1 and 6 of the accompanying drawings.
19. A common communications system as hereinbefore described with reference to FIG.s 1 and 5 of the accompanying drawings.



The Patent Office

17

Application No: GB 9610330.4
Claims searched: 1 to 19

Examiner: Mr Jared Stokes
Date of search: 12 July 1996

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.O): H4L (LDLX, LDSC, LDSK, LDSM, LECC)

Int CI (Ed.6): H04Q (7/20, 7/22, 7/30, 7/32, 7/38)

Other: On-Line: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2 294 844 A (Motorola) Whole document	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.